



Construction of a National Landslide Susceptibility Map for Portugal

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Landslides have occurred in mainland Portugal mostly triggered by rainfall and generated significant damage and disruption. Despite the existence of several landslide susceptibility models at the basin and municipal scale, no comprehensive landslide susceptibility evaluation was performed at the national scale until now.

In this work, three landslide inventories are used: (1) the DISASTER database, recorded on newspapers during the period 1865-2010, containing 235 points representing landslides that, independently of the number of people, caused either casualties, injuries, missing, evacuated or homeless people; (2) a complementary national landslide database containing 1421 points representing landslides that were reported by newspapers in Portugal during the period 1865-2010, thus including the DISASTER database, but also other occurrences independently of the magnitude of the respective losses; and (3) a detailed landslide inventory containing 7387 landslides represented by polygons and dated from 1950 up to 2015. This last inventory was produced with photo-interpretation and field work over 14 selected study areas distributed along the country and covering 11,547 square kilometers (13% of the country's surface).

Most landslides (62%) inventoried from newspaper sources (inventories (1) and (2)) are of unknown type, whereas the landslides belonging to inventory (3) are mostly of the slide type. For modelling, each landslide inventory was considered as a whole, not accounting the landslide type.

Seven landslide predisposing factors are considered: Elevation, Slope, Topographic Position Index (TPI), Lithology, Soil Type, Ecological Units and Available Water (difference between precipitation and potential evapotranspiration). The elevation, slope and TPI were extracted from the EU-DEM-3035 (25m pixel) provided by the European Environment Agency. The lithology was derived from the Geologic Map of Portugal (1:500 000 scale) provided by the Portuguese Geological Survey. The original 283 classes of the geological map were reduced to 25 lithological classes. The soil type, ecological units and available water were obtained from the Digital Environmental Atlas of Portugal at the 1:1 000 000 scale. Landslide predisposing factors were represented in a raster data structure with a 25m cell size.

The landslide susceptibility is assessed using the Information Value method. For comparison and control an Analytic Hierarchy Process (AHP) is also applied to landslide predisposing factors to establish relative weights based on the Saaty's scale of influence. The weighting of predisposing factors is performed twofold: first, between factors and, second, between the different classes of each factor. Landslide susceptibility models are validated and compared with success-rate and prediction-rate curves.

The obtained results point out two landslide susceptibility models as the most reliable: the AHP model and the statistical model produced with the Information Value method and the landslide inventory (3) that is successful extrapolated for the complete country.

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